

As it is, the initiated reader must be amazed at the amount of useful information which has been compressed into 450 small octavo pages. In every branch and sub-branch of mathematics all the fundamental definitions, theorems, and formulæ have been given, sufficient explanation being added to make the whole intelligible to the average mathematician. A similar plan has been adopted for the physical and astronomical parts, numerous tables of constants being given, as well as descriptions of apparatus. At the end of the book is a useful list of mathematical and physical books and periodicals.

We have noticed a few errata, e.g. p. 44, the first theorem of the mean is incorrectly stated, and p. 46,  $\int_0^{\infty} \frac{\sin bx}{x} dx$  is equal to  $\pi/2$  only if  $b > 0$ . These, however, are slight blemishes, inevitable in a first issue. In conclusion, we wish the "Taschenbuch" all the success it undoubtedly deserves.

#### OUR BOOK SHELF.

*An Introduction to the Science of Radio-activity.* By C. W. Raffety. Pp. xii+208. (London: Longmans, Green and Co., 1909.) Price 4s. 6d. net.

The aim of this book is to present a concise and popular account of the properties of the radio-active elements and of the theoretical conceptions which are involved in the study of radio-active phenomena. With this object in view, the treatment throughout is purely descriptive, and no attempt is made to develop the mathematical side of the subject. Nevertheless, the author has succeeded in describing and discussing most clearly the various phenomena of radio-activity.

The book is divided into three parts. The first part is descriptive, and, after a general note on the radio-active elements, is devoted to the consideration of the nature of the various radiations emitted by radio-active bodies. The characteristics of the  $\alpha$ ,  $\beta$ , and  $\gamma$  radiations are carefully explained.

In the second part of the book the author deals with the subject of radio-active transformations, and describes in detail the various disintegration products produced from thorium, uranium, and radium. Chapter iv. in this section contains an account of the theory of atomic structure from the electron point of view. The evidence drawn from various phenomena shows large variations in the number of electrons associated in the atom. The author gives the numbers calculated from experiments on cathode rays. The third part of the book is devoted to cathode, canal, and X-rays, and gives experimental details which should enable an amateur to carry out successfully a number of experiments with a small amount of apparatus. A feature of the book is the appendix, in which the author has collected and tabulated the physical constants of the  $\alpha$ ,  $\beta$ , and  $\gamma$  rays, the products of decay of the radio-active elements, with their rates of decay, and the absorption coefficients of the radiations emitted by the radio-active bodies.

Altogether the book can be heartily recommended to mathematical, as well as non-mathematical, readers who desire an acquaintance with the subject of radio-activity.

*British Mountain Climbs.* By George D. Abraham. Pp. xvi+448. (London: Mills and Boon, Ltd., 1909.) Price 7s. 6d. net.

MR. ABRAHAM here provides the lover of British mountaineering with a conveniently small and concise guide to the British rock-climbs. The

climbs are grouped around the most convenient centres, and detailed instructions as to how to perform the various expeditions safely are given. The book is provided with eighteen illustrations and twenty-one outline drawings, showing the principal routes. It is written in a bright, interesting style, and is sure to become a favourite among mountaineers who are willing to learn from it the beauties and difficulties of climbing at home.

*The Pond and other Stories.* By Carl Ewald. Translated from the Danish by Alexander Teixeira de Mattos. Pp. 320. (London: Everett and Co., 1909.) Price 6s. net.

THIS series of eleven stories deals with animal and plant life in a way dear to children. The birds and beasts talk to one another, and incidentally supply the reader with many familiar facts of nature-study. Each story is provided with a good illustration, and the easy colloquial English of the translator will be understood by the young children for whom the book is evidently intended.

#### LETTERS TO THE EDITOR.

(The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.)

##### Magnetic Storms.

DR. CHREE contends that magnetic observations have now reached a high pitch of perfection, and that their discussion is not lightly to be undertaken by outsiders. That is no doubt so, and there must be many features about magnetic storms which are known only to experts. But when we find experts in doubt on such a fundamental matter as whether the cause of those storms is to be found in the sun or in the earth, it appears to be worth while to emphasise some comparatively simple and fundamental considerations which may possibly have become rather covered up by a mass of information.

The simple points that I venture to emphasise, with all due deference to specialists, are:—

(1) That by reason of the high temperature and convulsions of the sun it is almost bound to emit electric projectiles.

(2) That when the visible sign of a solar eruption is aimed at the earth, magnetic storms are often felt, while they are not so frequently experienced from eruptions the emissions of which may be reasonably supposed likely to miss the earth.

(3) That, taking into account the varying aspect of places on the earth to a solar beam, such a stream of particles is well qualified to produce changes in all the magnetic elements during the course of a day—even though deflection by magnetic lines, and the effect of currents induced in the conducting layer of the upper atmosphere, were ignored. (I do not say that the details of a storm fit so greatly simplified a theory.)

(4) That a great beam of this kind is not likely to be uniform, but may be supposed to contain rays of special intensity, the passage of which will cause well-marked and rapid reversals, such as are observed.

(Of course, I never thought that the recent storm was over in fifteen minutes; it was common knowledge that it lasted for hours. I must have expressed myself badly if I conveyed such an idea.)

(5) That detection, in storm-recurrence, of any periodicity which corresponds at all closely with the period of the sun's relative axial rotation—such as is maintained by Mr. Maunder and apparently *half* admitted by Dr. Schuster—would surely be conclusive as to something solar in origin.

(6) And, especially, that simple calculations from known laboratory data show that the magnitude of the effect observed is not unreasonably great to attribute to local solar radio-active emissions.

Hesitation as to the truth of this last proposition was,

I understand, Dr. Chree's basis for his most anxious doubts; and the object of my letter was to try to remove at least this form of doubt from the minds of astronomers and responsible magneticians.

One more quite minor point I may take the opportunity of mentioning, though it is connected rather with a letter of Dr. Chree's in the *Times* than with his letter in *NATURE*.

(7) Disturbance of terrestrial rainfall—say an increase for a short period due to influx of cosmic nuclei—need not be supposed to modify the usual local *distribution* of rain, but only to increase its amount in the customary localities.

This I only venture to say very tentatively, and with no dogmatism at all. It is clear that the total rainfall all over the earth during a long period cannot exceed what the sun can evaporate in approximately the same period, and therefore depends more on the sun's total activity than on anything else. It is also clear that rain is a local circumstance, and that the conditions which determine whereabouts rain shall fall are mainly local. But I question whether either of these propositions really negatives the idea that cosmic causes may occasionally affect the rainfall during any given month, even in a specified locality.

OLIVER LODGE.

### Why has the Moon no Atmosphere?

PROCTOR ("The Moon," p. 334) says:—"It has been held, and not without some degree of evidence in favour of the theory, that in our Moon we have a picture of our Earth, as she will be at some far distant date . . . when her oceans and atmosphere have disappeared through the action of the same circumstances (whatever they may be) which have caused the Moon to be airless and oceanless."

The following considerations suggest what the circumstances referred to may have been, and present what seems a possible cause for the absence of an atmosphere.

(1) Apart from all theory, we know that the sun exerts a repulsive force on matter around him. The phenomena of comets' tails show this as clearly as the streamers from a flagstaff show that a wind is blowing. Kepler first suggested the existence of this force. Sir John Herchel, in his essay on comets, said, more than forty years ago, that "they have furnished us with a proof, amounting to demonstration, of the existence of a repulsive force directed . . . from the Sun."

(2) Maxwell in 1873 deduced from his electromagnetic theory the pressure of light, which Arrhenius in 1900 applied to explain the formation of comets' tails. Each particle projected from the comet, under the influence of the sun's heat when nearing the sun, being submitted to two opposing forces, viz. gravitation and the pressure of light, he pointed out that since the pressure varied as the surface, while the weight varied as the volume, *i.e.* one compared with the other, varied as the square of a number compared with its cube, then, when the particles were small enough, the repulsive force of the pressure might be many times as great as the force of attraction, and drive away the particles with great velocity.

As a common example of such action, I may remark that we have the case of a wind blowing on a newly macadamised road or on a single stone on the road. While the stones are unbroken the wind cannot move them, but when they are crumbled to powder it sweeps them away in clouds.

(3) In this way the sun exercises a sort of sifting process in space, sweeping away very small particles and drawing the larger ones towards him.

(4) Assuming that the moon had an atmosphere for many ages, the particles would be acted on by the repulsive force of the sun radiating from its centre, and by gravity directed to the centre of gravity of the moon. During the time that the moon retained its atmosphere it is evident that gravity must have been the preponderating force. The atoms, as Dalton called them, were not small enough to allow the pressure of light to prevail over the weight.

(5) But the atmosphere has disappeared, and we have to account for this fact. Can the particles have been in any way reduced in size?

If we are sure that the chemical atoms, as Dalton called

them, despite the protests of such men as Davy, Wollaston and Berzelius, cannot be decomposed or disintegrated, then an hypothesis to the contrary must be rejected.

(6) But the recent discoveries in radio-activity are opposed to this. It has been shown that the radio-active elements are disintegrating slowly and gradually from their own internal energy. The process has been going on for indefinite time, although only lately discovered accidentally because of certain radiations. Have we reason to believe that it is limited to these elements? Prof. Rutherford has pointed out that the existence of rayless changes in these elements "indicates the possibility that undetected changes of a similar character may be taking place in the non-radio-active elements" ("Radio-activity," p. 455, 2nd edition). If we suppose that such changes took place at the outer surface of the moon's atmosphere, resulting in particles sufficiently small, then part after part of the atmosphere may have been stripped away until the present condition has been reached.

(7) The same process may be going on now with the earth's atmosphere, notwithstanding the greater force of gravity.

Briefly, if the atmosphere of the moon was ever driven away—the repulsive force of the sun (pressure of light) is the only driving force we know of—the component particles must have been originally too heavy to be driven off, and were therefore in some way reducible; the transformations in the radio-active elements suggest a possible process.

Thus the present condition of the moon is an argument for the disintegration of some of the non-radio-active elements, and the argument is the stronger in proportion to the difficulty of finding a solution otherwise to this old astronomical problem.

ALEXANDER JOHNSON.

Montreal, Canada, September 30.

### A "Canaan Stone."

CAPTAIN B—, of the Brixham (Devon) trawler fleet, recently showed me what he termed a "Canaan stone." He told me that in the hands of his wife's mother it had effected many miraculous cures of diseases of the eye, and that by its use she had been especially successful in curing cataract. The stone was a polished sphere of agate, translucent, and of a faintly greenish-yellow tint, containing several red-brown patches due to the presence of iron. It was about  $\frac{3}{4}$ -inch in diameter, and had been drilled through the centre, as though it had at one time formed part of a necklace. The treatment simply consisted in "striking" (*i.e.* gently rubbing) the eye with the stone. No prayers or incantations were used, but it was essential that different parts of the stone should be used in different diseases, and the part used also varied with the colour of the patient's eyes. The stone was rubbed actually on the conjunctiva, not on the lids. The secret of the exact method of treatment died with the old lady, who is reported to have had quite an extensive ophthalmic practice, and I was appealed to in order that I might explain the secret to the present owners of the stone. Beyond the fact that the stone had been bought by its late owner from a man in Cornwall for 40s., no history was available.

The following extract from the Book of Tobit suggested itself to me as a possible explanation of the origin of the belief in the curative value of the stone:—

"When Tobias and Raphael came to the river Tigris, a fish leaped out of the water and would have devoured him, but the young man laid hold of it and drew it to land. The Angel bade Tobias open the fish, and take the heart, and the liver, and the gall, and put them up safely. . . . And the Angel said . . . As for the gall: it is good to anoint a man that a whiteness in his eyes shall be healed. . . . Tobias met his father at the door, and strake of the gall on his father's eyes . . . and Tobit recovered his sight."

It does not require a great stretch of the imagination to see a resemblance between this translucent, greenish-yellow stone, with its red-brown patches, and the distended gall-bladder of a fish, excised with small portions of liver adherent to its surface. The expression "to strike," for to anoint or rub, is still quite common in Devon. In the country districts a usual treatment for sprains or abrasions